

Research Article

Assessment of the Physico-chemical Quality of Surface Water in the Bolo and Niouniourou Rivers for Drinking Water Supply in the City of Fresco, Côte d'Ivoire

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Abstract

Access to safe drinking water remains a critical challenge in coastal West African urban centers, particularly in resource-limited settings such as Fresco, Côte d'Ivoire. This study evaluates the potabilization potential of the Bolo and Niouniourou rivers to inform sustainable water supply strategies in hydrogeologically complex estuarine environments. Water samples were collected from 20 stations during the peak flood period (July 2025) and analyzed for 24 physico-chemical parameters. Results revealed contrasting hydrochemical patterns between the two rivers driven by differential hydrodynamic forcing. The Bolo River maintained a freshwater facies (mean conductivity: 1,141 $\mu\text{S}/\text{cm}$; dissolved oxygen: 6.28 mg/L) under fluvial dominance, where high flood discharge effectively repelled saltwater intrusion through hydraulic flushing mechanisms. Conversely, the Niouniourou River exhibited severe mineralization (conductivity: 3,308 $\mu\text{S}/\text{cm}$; chlorides: 912 mg/L), attributable to tidal inertia and saltwater trapping that persists despite elevated discharge during the monsoon season. Compliance assessment against WHO drinking water guidelines confirmed the Bolo River's suitability for conventional treatment pathways, whereas the Niouniourou River's chronic salinity burden renders it unsuitable for potabilization without prohibitively expensive desalination technologies. These findings underscore the fundamental importance of hydrodynamic forcing in governing coastal water resource quality and accessibility. The study demonstrates that site-specific hydrodynamic assessment is essential for evidence-based water supply planning in estuarine contexts.

Keywords

Drinking Water Supply, Hydrochemistry, Physicochemical Parameters, River Bolo, River Niouniourou, Fresco (Côte d'Ivoire), Coastal Water Potabilization

1. Introduction

Coastal West African urban regions face an acute water crisis driven by rapid demographic expansion, climate variability, infrastructure deterioration, and groundwater salinization. Projected population increases from 36 million (2020) to over 80 million (2050) substantially escalate freshwater demand.

Climate change reduces precipitation predictability and alters hydrological cycles. Aging infrastructure cannot meet expanding needs. Coastal aquifer salinization through saltwater intrusion diminishes freshwater availability. Irregular seasonal rainfall compromises supply sustainability. These converging

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pressures threaten the viability of conventional water supply systems across West Africa [1-3]. Millions of city dwellers are therefore in a situation of permanent water stress, where access to drinking water becomes increasingly precarious. The city of Fresco, located on the Ivorian coast, perfectly illustrates this issue. The city has faced a shortage of drinking water for several years, causing concern among residents and local authorities. This situation results in frequent water cuts affecting all neighborhoods in the municipality. According to the Water Distribution Company of Côte d'Ivoire (SODECI), water supply is managed according to a rotating distribution schedule: some neighborhoods receive water two days a week, others only once, or sometimes not at all. This alternating management is due to only one of the three available boreholes functioning, and even then at only 60% capacity, which is insufficient to cover the population's needs. Faced with this situation, residents of the least-served neighborhoods often have to travel to the city center or resort to private suppliers, who sell water at high prices. Local authorities advocate the construction of a water tower to permanently address this crisis [4]. Rapid urbanization has led to a decrease in pressure from the only water tower that originally supplied the city. This infrastructure has proven insufficient to meet the growing needs of the population. Although new boreholes with capacities of 12 and 14 m³ have recently been acquired, a more ambitious project to reinforce the potable water supply system is being studied. This project aims to use the Bolo River, located 5 km north of Fresco, as a source of supply [5]. However, utilizing these coastal rivers for drinking water production raises

complex scientific questions related to their specific hydrodynamics. The Bolo and Niouniourou rivers are tropical estuarine systems subject to a dual antagonistic influence: continental hydrological forcing (monsoon floods) and oceanic forcing (tides). Water quality in these land-sea interfaces is governed by the precarious balance between freshwater inputs, which act as dilution factors, and saltwater intrusion, which mineralizes the water and alters physico-chemical equilibria [6, 7]. While these rivers support local economic activities, their suitability for treatment for human consumption remains poorly documented, particularly regarding the impact of these mixing mechanisms on potability parameters.

To date, there is a critical lack of data on the physico-chemical characteristics of these two rivers and their respective responses to saltwater intrusion. The present study therefore aims to assess the surface water quality of the Bolo and Niouniourou rivers with a view to their use for drinking water supply. The objective is to characterize the dominant hydrochemical facies and analyze the influence of estuarine dynamics on the compliance of these waters with drinking water standards.

2. Materials and Methods

Study Area

The Niouniourou River (140 km) and the Bolo River (84 km) are located between longitudes 6°0'0" W -- 5°30'0" W and latitudes 5°0'0" N -- 5°50'0" N in southwestern Côte d'Ivoire (Figure 1).

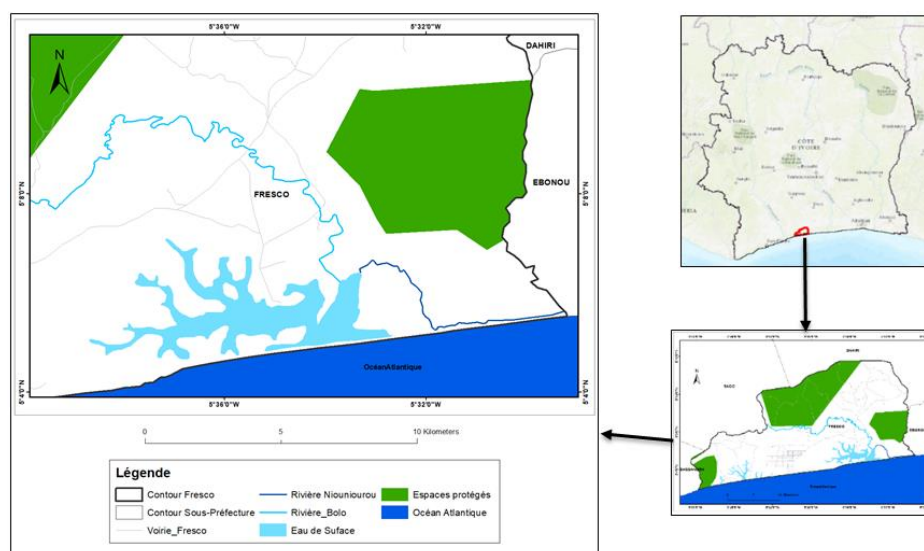


Figure 1. Study Area.

These rivers flow into the Fresco lagoon, a site classified under the Ramsar Convention. The climate is humid tropical, characterized by four seasons: two wet seasons—a major one (April-July) and a minor one (October-November), and two less rainy (or dry) seasons—a major one (December-March)

and a minor one (August-September) [8]. The study area presents an undulating relief divided into forest and lagoon zones, with numerous plateaus, marshy lowlands, valleys, and some hills. The Bolo and Niouniourou rivers are part of this complex hydrographic network characteristic of the Ivorian

coastal zone, where many watercourses flow into lagoons before reaching the sea [9, 10]. The coastal zone of Côte d'Ivoire has a particular geological configuration, contrasting sharply with the interior of the country. This region provides an exceptional window into the country's geological history, characterized by the presence of a coastal sedimentary basin in sharp contrast to the Precambrian bedrock that dominates

most of the territory.

Sampling Strategy and Analysis Techniques.

Analyses were conducted on water samples collected from the Bolo and Niouniourou rivers during the flood period in July 2025 at 20 stations distributed across both rivers as shown in the Figure 2.

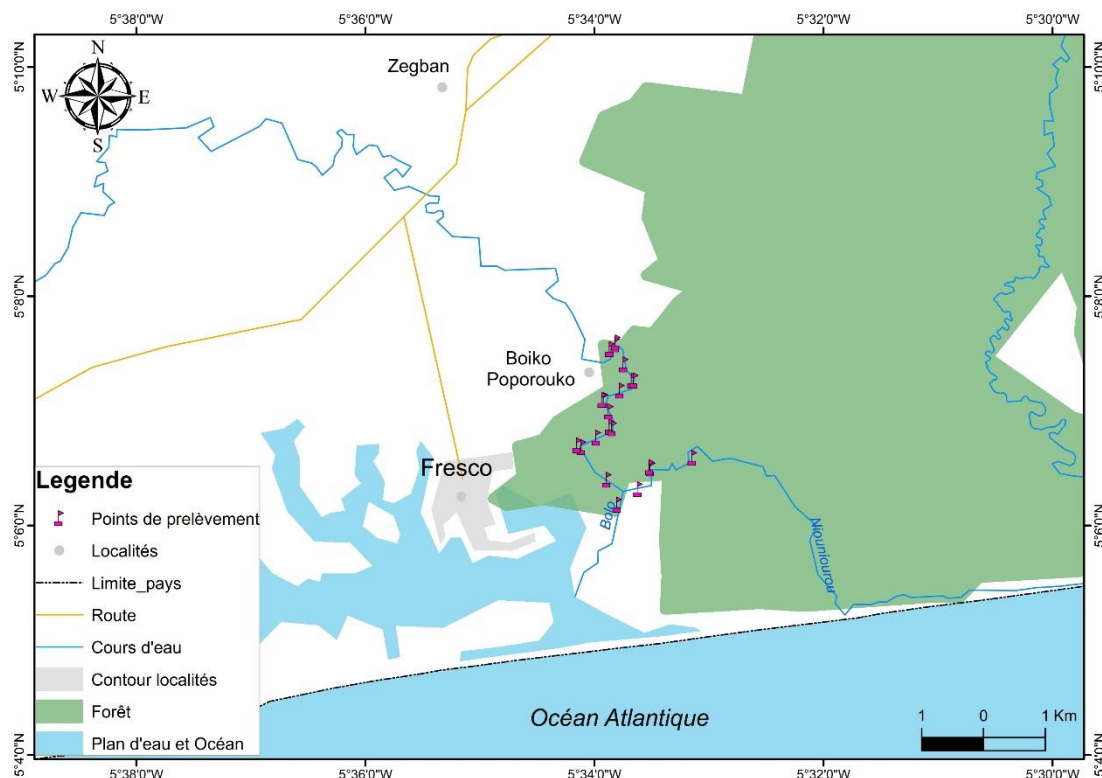


Figure 2. Sampling Sites.

Twenty sampling stations were positioned in transition zones downstream of meander apexes to mitigate hydraulic asymmetry caused by helical flows and ensure cross-sectional homogeneity [11, 12]. Temporally, the study targets the flood period (July 2025) as a worst-case scenario. This approach assesses the system's resilience to saltwater intrusion during peak dilution and quantifies the maximum contaminant load. Chemical analyses were performed on 20 samples taken a few centimeters below the water surface. Temperature ($T^{\circ}\text{C}$), pH, dissolved oxygen (DO), redox potential (Eh), electrical conductivity (EC), salinity, and total dissolved solids (TDS) were measured in situ using a portable multiparameter waterproof device hi 98194, ph/ec/od, HANNA®. Suspended solids were analyzed by centrifugation (NF, 1978). Analysis of nitrogen parameters and phosphorus was performed by colorimetric spectrophotometry using standardized HACH methods. Nitrates were determined by the cadmium reduction method (HACH 8192). Nitrites were analyzed directly by the diazotization method (HACH 8507). Ammonium was determined by Nessler's method (HACH 8038). Phosphates were analyzed

by the ascorbic acid method (HACH 8048). Sulfates were measured by the turbidimetric method using spectrophotometry at 420-450 nm. Chlorides (HACH 8206) were analyzed by mercuric nitrate titration using a digital titrator. Calcium hardness (HACH 8204) was measured by acid ethylenediaminetetraacetic (EDTA) titration. Total hardness (HACH 8213) used EDTA titration. Alkalinity (HACH 8203) was determined by titration with sulfuric acid. Potassium (HACH 8049) was analyzed by the tetraphenylborate method with multi-range turbidimetric measurement (0.1-7.0mg/L, 1.0-70mg/L, and 10-700mg/L K). Chemical oxygen demand (COD) (HACH 8000) was measured using dichromate digestion. Biochemical oxygen demand over 5 days (BOD_5), according to NF EN 1899-1, used the dilution method with seeding and nitrification inhibition.

Hydrochemical data obtained were evaluated for normality using the Shapiro-Wilk test, defined as (1):

$$W = \frac{(\sum_{i=1}^n a_i x_i)^2}{\sum_{i=1}^n (x_i - \bar{x})^2} \quad (1)$$

at ($\alpha = 0.05$), parameters with $p > 0,05$ were classified as normal. Variance homogeneity was verified using Levene's test, expressed as (2):

$$W = \frac{(N-k) \sum_{i=1}^k n_i (Z_i - Z_{..})^2}{(k-1) \sum_{i=1}^k \sum_{j=1}^{n_i} (Z_{ij} - Z_i)^2} \quad (2)$$

before parametric analyses. Inter-river comparisons employed Student's t-tests formulated as (3):

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}} \quad (3)$$

with pooled variance calculated as (4):

$$s_p^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1 + n_2 - 2} \quad (4)$$

for the 9 parameters with normal distributions and Mann-Whitney U tests calculated as (5):

$$U = \min \left(n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1, n_1 n_2 + \frac{n_2(n_2+1)}{2} - R_2 \right) \quad (5)$$

for the 15 parameters with at least one non-normal distribution. All tests were two-tailed with $p < 0.05$ considered significant.

Statistical analyses were performed using STATA 17.0, employing built-in functions for normality assessment, variance homogeneity testing, and parametric and non-parametric comparisons.

3. Results

3.1. Statistical Analysis of Bolo River

Statistical analysis of the physico-chemical parameters of the Bolo River reveals characteristics typical of a tropical coastal river system with marked spatial heterogeneity. The mean pH is 6.90 ± 0.68 , ranging from 5.7 to 7.82. Electrical conductivity shows strong spatial variability, averaging $1,141 \pm 941 \mu\text{S}/\text{cm}$ (range 198-3,480 $\mu\text{S}/\text{cm}$). The temperature remains stable at $28.5 \pm 0.5^\circ\text{C}$ (range 27.5-29.5 $^\circ\text{C}$). Dissolved oxygen averages $6.28 \pm 0.28 \text{ mg}/\text{L}$ (range 5.59-6.71 mg/L). Average salinity of $0.58 \pm 0.53 \text{ g}/\text{L}$ labels this system as fresh to slightly brackish water. Average TDS is $1,138 \pm 937 \text{ mg}/\text{L}$. Nitrates have an average value of $2.2 \pm 1.3 \text{ mg}/\text{L}$. Phosphates average $0.306 \pm 0.121 \text{ mg}/\text{L}$. Organic pollution remains moderate with mean values of suspended solids ($14.3 \pm 11.9 \text{ mg}/\text{L}$), COD ($7.2 \pm 2.2 \text{ mg}/\text{L}$), and BOD₅ ($3.0 \pm 0.9 \text{ mg}/\text{L}$), in ranges typical of anthropized tropical rivers (Table 1).

Table 1. Statistics of the Bolo River.

	Min	Max	Average	SD	Median	CV	IC 95%	Skewness	P95
pH	5,7	7,82	6,9	0,68	6,95	9,8	[6,53; 7,27]	-0,564	7,73
Cond	216	3480	1355,62	917,01	1212	67,6	[801,47; 1909,76]	0,977	2982
TDS	196	3450	1138,5	936,62	1090	82,3	[639,41; 1637,59]	1,047	2850
NTU	1,5	27,6	9,28	6,19	7,64	66,7	[5,54; 13,02]	2,04	18,84
Temp	27,9	29,5	28,59	0,48	28,7	1,7	[28,30; 28,88]	0,148	29,26
ORP	-81	40,1	-29,73	37,62	-37,55	-126,5	[-49,78; -9,69]	0,669	36,2
DO	5,59	6,71	6,28	0,28	6,31	4,5	[6,13; 6,43]	-1,014	6,65
Res	0,28	0,75	0,46	0,16	0,43	35,5	[0,36; 0,56]	0,708	0,74
Sal	0	1,8	0,58	0,53	0,5	90,4	[0,30; 0,86]	0,951	1,5
% Sat	71,2	87,4	80,78	3,88	81,3	4,8	[78,71; 82,84]	-0,786	86,42
MES	1	35	14,31	11,86	10,5	82,9	[7,99; 20,63]	0,544	33,5
Ca ²⁺	6,4	24,4	14,862	4,885	14,8	32,9	[11,91; 17,81]	0,534	23,68
Mg ²⁺	3,2	62,8	22,615	16,437	18,8	72,7	[12,68; 32,55]	1,216	50,62
Na ⁺	8,5	144,3	57,462	38,842	49,1	67,6	[33,99; 80,93]	1,046	129,18
K ⁺	1,6	26,6	10,615	7,155	9,1	67,4	[6,29; 14,94]	1,045	23,84
HCO ³⁻	28	36,6	33,224	2,506	33,52	7,5	[31,889; 34,559]	-0,82	36,6
Cl ⁻	34	888	293,938	249,279	266,5	84,8	[161,106; 426,769]	1,06	771,75
SO ₄ ²⁻	0	138	41,438	40,405	38	97,5	[19,907; 62,968]	1,372	131,25

	Min	Max	Average	SD	Median	CV	IC 95%	Skewness	P95
BOD ₅	1,5	4,4	2,95	0,89	2,95	30,2	[2,48; 3,42]	-0,025	4,25
COD	4	11	7,19	2,17	7	30,1	[6,03; 8,34]	0,157	10,25
PO ₄ ³⁻	0,12	0,63	0,306	0,121	0,285	39,5	[0,241; 0,370]	1,26	0,51

3.2. Statistical Analysis of Niouniourou River

Statistical analysis of the physico-chemical parameters of the Niouniourou River reveals a coastal tropical aquatic system under strong marine influence and anthropogenic pressure. Mean pH is 6.76 ± 0.44 (range 6.50-7.42). Electrical conductivity is high, averaging $3,308 \pm 611 \mu\text{S}/\text{cm}$ (range 2,420-3,760 $\mu\text{S}/\text{cm}$). Temperature remains homogeneous at $27.9 \pm$

0.4°C (range 27.3-28.3 $^\circ\text{C}$). Dissolved oxygen shows concerning levels at $5.09 \pm 1.08 \text{mg}/\text{L}$ (range 4.26-6.67 mg/L) with strong spatial variability, with minimum values approaching the critical threshold of 4 mg/L for tropical aquatic fauna. Salinity is elevated and homogeneous ($1.70 \pm 0.28 \text{g}/\text{L}$), categorizing this system as slightly brackish water under permanent marine influence. Average TDS is ($3,300 \pm 609 \text{mg}/\text{L}$). The mean suspended solids are $15.2 \pm 12.1 \text{mg}/\text{L}$; COD: $6.2 \pm 1.7 \text{mg}/\text{L}$; BOD₅: $2.9 \pm 1.4 \text{mg}/\text{L}$ (Table 2).

Table 2. Statistics of the Niouniourou River.

	Min	Max	Average	SD	Median	CV	IC 95%	Skewness	P95
pH	6,5	7,42	6,76	0,44	6,56	6,52	[6.33; 7.19]	1,14	7,29
Cond	2420	3760	3307,5	610,54	3525	18,46	[2709.17; 3905.83]	-0,96	3743,5
TDS	2420	3760	3300	609,21	3510	18,46	[2702.98; 3897.02]	-0,92	3743,5
NTU	12,8	20,3	15,575	3,26	14,6	20,95	[12.38; 18.77]	0,91	19,46
Temp	27,3	28,3	27,875	0,42	27,95	1,50	[27.46; 28.29]	-0,58	28,25
ORP	-58,3	-6,7	-21,075	24,86	-9,65	-117,97	[-45.44; 3.29]	-1,14	-7,03
DO	4,26	6,67	5,0925	1,08	4,72	21,24	[4.03; 6.15]	0,97	6,40
CE	333	3730	2348,25	1434,52	2665	61,09	[942.42; 3754.08]	-0,71	3575,5
Res	269	382	305	53,19	284,5	17,44	[252.88; 357.12]	0,94	369,55
Sal	1,3	1,9	1,7	0,28	1,8	16,64	[1.42; 1.98]	-0,82	1,9
% Sat	53,7	82,6	63,475	12,99	58,8	20,46	[50.75; 76.20]	1,03	79,13
MES	7	33	15,25	12,12	10,5	79,48	[3.37; 27.13]	1,00	30
NO ₃ ⁻	1,9	3,8	2,5	0,88	2,15	35,02	[1.64; 3.36]	1,08	3,56
NO ₂ ⁻	0,108	0,136	0,122	0,01	0,122	10,19	[0.11; 0.13]	0,00	0,13
NH ₃	0,54	0,68	0,61	0,06	0,61	10,19	[0.55; 0.67]	0,00	0,67
Ca ²⁺	20	31,2	26,9	4,82	28,2	17,90	[22.18; 31.62]	-0,84	30,78
Mg ²⁺	45,7	70,1	59,775	11,06	61,65	18,50	[48.94; 70.61]	-0,39	69,62
HCO ₃ ⁻	30,5	36,6	32,94	2,99	32,33	9,07	[30.01; 35.87]	0,31	36,23
Cl ⁻	667	1022	912,25	166,39	980	18,24	[749.19; 1075.31]	-1,04	1020,05
Na ⁺	108,4	166,1	148,25	27,04	159,25	18,24	[121.75; 174.75]	-1,04	165,78
K ⁺	20	30,7	27,375	5,01	29,4	18,30	[22.47; 32.28]	-1,03	30,64
SO ₄ ²⁻	66	101	86,5	16,62	89,5	19,22	[70.21; 102.79]	-0,33	100,7
DCO	4	8	6,25	1,71	6,5	27,33	[4.58; 7.92]	-0,43	7,85

	Min	Max	Average	SD	Median	CV	IC 95%	Skewness	P95
DBO ₅	1,2	4,3	2,925	1,44	3,1	49,18	[1.52; 4.33]	-0,24	4,24

3.3. Hydrochemical Facies

Hydrochemical facies analysis shows a distinct chlorinated-sodium signature between the two rivers. The Bolo River shows a moderate chlorinated-sodium facies with mean chloride concentrations of 294mg/L and sodium of 48mg/L. The Niouniourou River develops a pronounced chlorinated-sodium facies with much higher chloride (912mg/L) and sodium (148mg/L) levels.

Comparative analyses reveal significant differences between the two systems for 9 out of 14 tested parameters ($p < 0.05$). The Niouniourou River shows significantly higher mineralization (conductivity: $p = 0.0029$; chlorides: $p = 0.0017$; sodium: $p = 0.0017$). Conversely, the Bolo River is characterized by higher dissolved oxygen ($p = 0.0006$) and reduced mineralization.

4. Discussion

Temperature measurements indicate stable tropical conditions with an average of $28.53 \pm 0.54^\circ\text{C}$ for the Bolo River (range 27.50 - 29.50°C) and $27.88 \pm 0.42^\circ\text{C}$ for Niouniourou (27.30 - 28.30°C). This low thermal variability reflects tropical coastal climate regulation.

A physico-chemical study of the Ezu River in Nigeria [13] noted temperatures of $27.97 \pm 1.32^\circ\text{C}$ under similar conditions, comparable to those of the Bolo and Niouniourou Rivers. Similar observations were made [14] in the coastal waters of Miri. Conversely assessment of physico-chemical parameters in the coastal surface waters of Al-Hoceima, Morocco, and reported seasonal temperatures of 15.59 - 21.8°C with summer peaks reaching 21.57°C [15]. These temperature ranges are suitable for conventional surface water treatment processes.

The pH analysis reveals slightly acidic to neutral conditions with an average of 6.90 ± 0.68 for Bolo (5.70 - 7.82) and 6.76 ± 0.44 for Niouniourou (6.50 - 7.42). This spatial variability reflects local geochemical processes and organic decomposition in the tropical environment. pH evaluation by of Lake Albert in the Democratic Republic of Congo reports a mean pH of 7.2 ± 0.4 , close to these values [16]. Assessments in southwest coastal Bangladesh shows pH ranging between 7.8 - 8.4 [13], slightly higher than the pH observed in the Bolo and Niouniourou Rivers but in the same range. The values comply with WHO drinking water guidelines (6.5 - 8.5), with 80% of Bolo samples and 100% of Niouniourou samples compliant.

Conductivity shows strong spatial heterogeneity at $1,141 \pm 941\mu\text{S/cm}$ for Bolo and $3,308 \pm 611\mu\text{S/cm}$ for Niouniourou. This variability reflects a differential saline intrusion gradient

between the two systems. Analysis of saline intrusion in Lagos [17] notes conductivities $>2,500\mu\text{S/cm}$ in zones of strong intrusion, similar to the maximum observed values here. According to WHO standards ($\leq 2,500\mu\text{S/cm}$), 87.5% of Bolo samples are compliant versus only 25% for Niouniourou. Furthermore, salinity measurements show a sharp hydrochemical contrast: $0.58 \pm 0.53\text{ g/L}$ for Bolo vs $1.70 \pm 0.28\text{ g/L}$ for Niouniourou. This difference reflects the variable intensity of marine influence across the two river systems.

Oxygenation levels are satisfactory at $6.28 \pm 0.28\text{mg/L}$ for Bolo and $5.09 \pm 1.08\text{mg/L}$ for Niouniourou. This difference suggests a higher self-purification capacity for Bolo. According to aquatic life protection thresholds ($\geq 5\text{mg/L}$), 100% of Bolo samples are compliant versus 75% for Niouniourou.

The hydrochemical heterogeneity observed between the Bolo and Niouniourou rivers suggests a differential response of these estuarine systems to hydrological forcing during the monsoon. Water quality in these interfaces is governed by the competition between freshwater inputs (pluvial and fluvial) and tidal prism intrusion. On the Bolo River, low salinity and conductivity values downstream testify to the efficiency of a hydraulic flushing mechanism. The freshwater signature indicates that outgoing flow successfully counteracts saltwater intrusion. This dynamic is corroborated by high dissolved oxygen levels, characteristic of rapid water mass renewal limiting stratification. Conversely, on the Niouniourou River, the persistence of high mineralization despite the rainy season reveals marked hydrodynamic inertia. These chemical indicators suggest that freshwater inputs are insufficient to fully repel marine waters, favoring brackish water trapping by the tide. This partial confinement explains quality degradation and lower dissolved oxygen.

Turbidity values are $9.25 \pm 5.98\text{ NTU}$ for the Bolo River and $15.57 \pm 3.26\text{ NTU}$ for the Niouniourou River. These high levels indicate the influence of tropical erosion and sediment inputs. With the WHO threshold at 5 NTU, only 12.5% of Bolo samples and 0% of Niouniourou samples are compliant. Analysis of major anions reveals marked chloride dominance at $293.9 \pm 249.3\text{mg/L}$ for Bolo (34 - 888mg/L) vs $912.2 \pm 166.4\text{mg/L}$ for Niouniourou (667 - $1,022\text{mg/L}$). The $\text{Cl}^-/\text{HCO}_3^-$ ratio is 8.8 for Bolo and 27.7 for Niouniourou, indicative of differential saline intrusion intensity. Global river analysis [18] notes an 81% increase in chloride flux to oceans, validating the observations of saline enrichment here. Bicarbonates are stable ($33.2 \pm 2.5\text{mg/L}$ Bolo, $32.9 \pm 3.0\text{mg/L}$ Niouniourou) due to HCO_3^- is buffering role in tropical environments. Moderate sulfates ($41.4 \pm 40.4\text{mg/L}$ Bolo, $86.5 \pm 16.6\text{mg/L}$ Niouniourou) fit in with carbonate weathering processes that establish geogenic sources as dominant in crystalline contexts.

Cation composition shows sodium dominance ($47.8 \pm 40.5\text{mg/L}$ Bolo vs $148.2 \pm 27.0\text{mg/L}$ Niouniourou) in the order $\text{Na}^+ > \text{Mg}^{2+} > \text{Ca}^{2+}$, typical of systems under marine influence. This cationic signature translates the hydrochemical evolution from natural calcium bicarbonate facies towards chlorinated sodium facies under increasing marine influence. Moderate calcium ($13.5 \pm 5.2\text{mg/L}$ in Bolo, $26.9 \pm 4.8\text{mg/L}$ in Niouniourou) reflect carbonate weathering processes. Variable magnesium ($18.9 \pm 16.7\text{mg/L}$ Bolo with a factor $52.3\times$, $59.8 \pm 11.1\text{mg/L}$ Niouniourou) reveals geochemical heterogeneity.

5. Conclusions

The study of physico-chemical parameters of surface waters in the Bolo and Niouniourou rivers reveals distinct hydrochemical features driven by contrasting estuarine dynamics. Statistical analysis of 24 parameters across 20 sampling stations highlights significant geochemical differentiation ($p < 0.05$ for 64% of parameters). The Bolo River is characterized by a freshwater facies ($\text{pH } 6.90 \pm 0.68$; $\text{O}_2 \ 6.28 \pm 0.28\text{mg/L}$) maintained by an apparent strong fluvial dominance. The low salinity levels observed downstream testify to the efficiency of the hydraulic flushing mechanism during the flood period, which effectively repels saltwater intrusion. This hydrochemical resilience makes it a viable candidate for drinking water supply with conventional treatment (coagulation-filtration). Conversely, the Niouniourou River exhibits systemic excessive mineralization (Conductivity: $3,308 \pm 611\mu\text{S/cm}$; Chlorides: 912mg/L) resulting from tidal inertia and saltwater trapping. This chronic salinity confirms its unsuitability for standard potabilization without desalination processes. The treatability of these coastal resources is governed by the hydrodynamic balance between fluvial inputs and tidal forcing. Given climate challenges, future research must prioritize modeling these freshwater-saltwater interfaces to design resilient and sustainable treatment strategies.

Abbreviations

SODECI Water Distribution Company of Côte D'Ivoire

Conflicts of Interest

The authors declare no conflicts of interest.

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